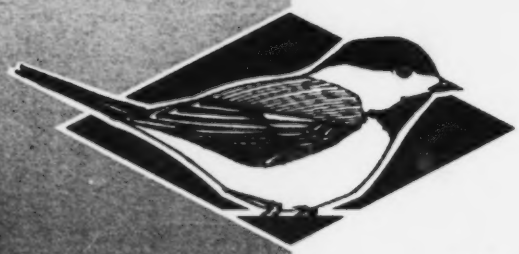

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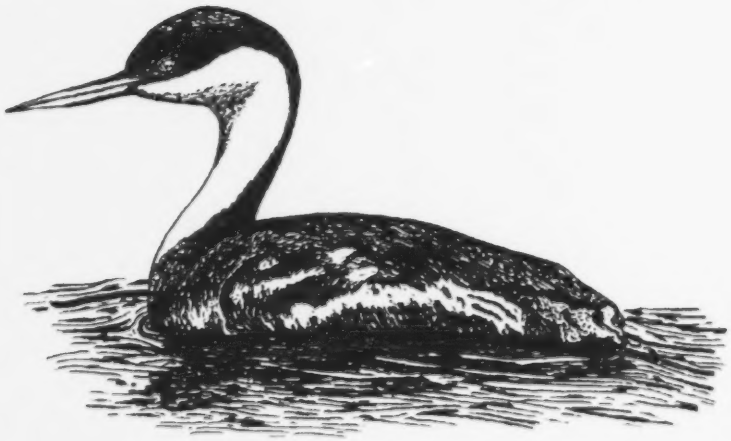
Western Grebes (*Aechmophorus occidentalis*) of Alberta: 2006 Field Summary



Alberta Species at Risk Report No. 121

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Western (*Aechmophorus occidentalis*) Grebes in Alberta: 2006 Field Summary

Cindy Kemper
Hugh Wollis
Christine Found
Dave Prescott
and
Mark Heckbert

Alberta Species at Risk Report No. 121
December 2008

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

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EXECUTIVE SUMMARY

This project was initiated in 2001 to monitor population trends and distribution of western grebes (*Aechmophorus occidentalis*) and eared grebes (*Podiceps nigricollis)* in Alberta. The project began in the Stony Plain study area with the intent to expand to other areas of the province where this species occurs. Now completing its sixth season, the study has expanded to the northeast, the northwest, and to more areas within the Parkland Natural Region of the province. For the first time, data for all of the above are summarized in one document. This report deals solely with western grebes.

We estimated the population of western grebes on all lakes surveyed to be 10 738 adults which represents about 10% of the North American population. Five lakes had populations large enough to be considered nationally significant, while an additional three lakes were classified as regionally significant.

Western grebe colonies with more than 500 nests (nationally significant) were found in Cold Lake, Lac La Biche, Lesser Slave Lake and Buffalo Lake. Four other lakes contained between 100 and 500 nests (regionally significant). The colony at Utikuma Lake, that numbered over 1 700 birds in 2000, had, inexplicably, all but disappeared in 2006. Further, while there have been slight to moderate increases of the number of western grebe nests at the three Stony Plain area lakes (Lake Isle, Lac Ste. Anne and Wabamun Lake), the total 2006 count was less than 50% of the 2003 total. This measured decline over the past six years, combined with the knowledge that: 1) the majority of birds are breeding on just eight lakes; 2) some large historical western grebe colonies are no longer occupied; and 3) encroachment of human activities on existing habitat continues, is ample cause for concern over the long-term fate of western grebes in Alberta.

1.0 INTRODUCTION

Western grebes (*Aechmophorus occidentalis)* are widely distributed across western and central North America, with some colonies numbering into the thousands (Hanus et al. 2002a). These colonial-nesting waterbirds build precarious nests of soft vegetation that are either entirely free-floating, or secured to emergent vegetation (Storer and Nuechterlein 1992).

Western grebes are highly sensitive to human disturbance associated with recreation and development, and thus have the potential to become threatened over the long-term. Under the General Status ranking system in Alberta, western grebes are currently classified as 'Sensitive' (Alberta Sustainable Resource Development 2006). The present project was initiated in 2001 in response to relatively sparse data available to quantify this ranking. Surveying protocols have since been developed and refined, population trends and species distribution within the study area are being monitored, and specific threats to populations have been identified.

A synthesis of previous data for western grebes prior to 2001 is provided in Hanus (2002). The information in this report represents the findings from the sixth year of surveying western grebes within what was referred to in previous reports as the "Stony Plain Study Area". Previous data from the Stony Plain study area for 2001 to 2005 are found in Hanus et al. (2002a, 2002b, 2003), Berg et al. (2004), and Berg and Wollis (2005, unpublished report). While western grebe data in the other areas have been previously reported (Hanneman and Heckbert 2001; Found and Hubbs 2004), this is the first year in which western grebe data from all study regions in Alberta are compiled into one document.

Objectives for 2006 were:

(1) to count nests of western grebes at the known primary colonies previously inventoried; and

(2) to inventory other lakes in the province where colonies are known or suspected, and potentially locate new colonies.

2.0 STUDY AREA

The study lakes in this project comprise most of the summer range of western grebes in Alberta north of Red Deer (Figure 1). Specific details of lakes with active and/or historical grebe breeding colonies are described in Hanus et al. (2002b).

The Canadian extent of the summer breeding range for western grebes includes British Columbia and the three prairie provinces. Within Alberta, this range extends as far north as the Peace River area, and south to the U.S. border, however there are few colonies in the grassland natural region portion of the province (Hanus 2002).The southern limit of the North American range reaches into the western United States as far as California, Arizona, and New Mexico (Storer and Nuechterlein 1992). In winter, grebes migrate to the Pacific coast. Western grebe breeding colonies with greater than 500 nests have been known to exist at several lakes in the province

including: Lac Ste. Anne, Wabamun Lake, Lac La Biche, Utikuma Lake, Lesser Slave Lake, and Cold Lake. Colonies were also suspected but had not been enumerated at Gull and Buffalo lakes.

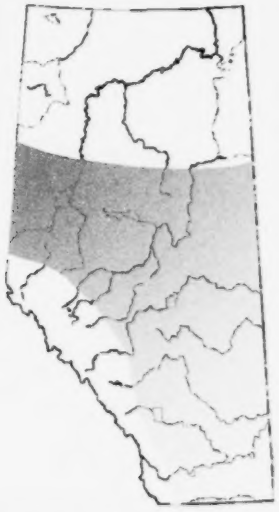

Figure 1: Geographic range of western grebes in Alberta

3.0 METHODS

The focus in 2006 was to monitor the primary colonies identified in previous surveys and to investigate suspected colonies in northwest Alberta and Buffalo Lake. Field surveys spanned mid-June to early August. In June, during the nesting season, we confirmed the presence of previously-known western grebe colonies, and checked several other lakes that had the potential to support a colony. Further, we conducted a meandering shoreline survey (Hanus et al. 2002b) on Wabamun Lake and a portion of Lac Ste. Anne to check whether any other colonies existed. Methods used at each lake in both years follow those of Hanus et al. (2002b) and are listed in Appendix 1.

Total nest surveys for western grebes were undertaken using methods outlined in Hanus et al. (2002b). To minimize disturbance of nesting adults, surveys were timed such that the majority of eggs had already hatched, and the nest sites had thus been abandoned.

Habitat characteristics, such as the type of vegetation where nests were located, were also recorded.

Colony locations were recorded using Garmin™ model Map 60CS handheld global positioning (GPS) units set to NAD 83.

Population and brood counts were conducted on Lac Ste. Anne on July 25th and on Wabamun Lake on August 10th, using the Systematic Boat Technique of Hanus et al. (2002b). The average distance between each transect was approximately 800 m.

4.0 RESULTS

4.1 General Observations on Nesting

At the Lac Ste. Anne colony in 2006, there was a visible boundary between the area that contained remnant stems of last season's dry bulrush (*Scirpus* sp.) stems and the area that contained only this year's new growth (i.e., where ice scoured the previous year's growth). Western grebes appeared to select the bulrush stands with carryover vegetation for nesting, as the colony boundary clearly corresponded with the border between this dry vegetation and the current year's growth; no nests were found in the stands that contained only new growth. At Wabamun, Lesser Slave, and Buffalo lakes, nesting had also commenced in old bulrush. At Cold Lake, however, the colony was located in new-growth bulrush as there was little vegetation left from the previous year. At Lake Isle, where grebes were nesting around an island reef, the shallow water at the edge of the reef supported cattail (*Typha* sp.) with bulrushes in deeper water. There were only a few nests in the fringe of cattails in 2005 and 2006, as most nests were built in the bulrushes along a gradient from old to new growth. The Lac La Biche colony was the only other colony where some of the nests were located in cattail.

4.2 Numbers of Western Grebes

We found western grebes nesting on nine lakes surveyed in Alberta in 2006. Based on nest count data and population surveys, our minimum estimate for adult western grebes across all surveyed lakes in Alberta is 10 738 individuals. We did not survey western grebes on three lakes that had historical colonies (Cardinal, George [in northwestern Alberta] and Gull lakes). Figure 2 shows the distribution of historical (as outlined in Hanus 2002) and current western grebe colonies of >500 adults. Detailed results from western grebe surveys for each lake can be found in the sections below.

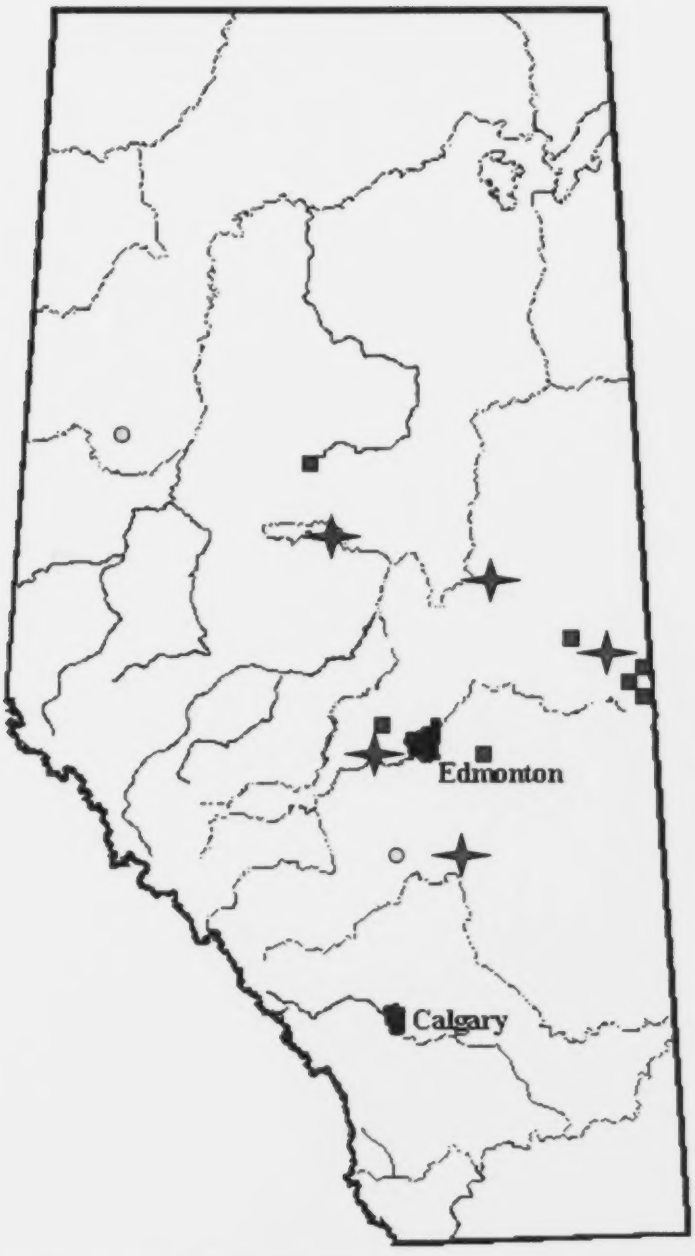

Figure 2: Distribution of historical (square), and current (2006, star) western grebe colonies with over 500 breeding birds. Round dots indicate historical colonies that were not surveyed in 2006.

Table 1: 2006 Western grebe population and nest count data. Lakes surveyed between June 27 and August 10, 2006.

Waterbody	Maximum est. # of adults[1]	NESTS				
		Colony (if applicable)	Total # of Nests	% intact	% partially submerged	% submerged
Buffalo Lake	1030	Western reed	243	25	65	10
		Eastern reed	272	20	45	35
Brock Lake	6		0	N/A		
Cold Lake	1876		938	22	63	15
Hastings Lake	440		23	70	13	17
			197	48	32	20
Isle Lake	208	Eastern Island	104	83	17	0
Lac La Biche	2812	Northwest shore	1406	22	5	82
Lac La Nonne	10		0[2]	N/A		
Lac Ste. Anne	176		88	84	2	92
Lesser Slave Lake	2720	Joussard	1360	58	13	82
Moose Lake	353[3]		156	30	39	31
Sandy Lake	21		0	N/A		
Thunder Lake	3		0	N/A		
Utikuma Lake	20		0	N/A		
Wabamun Lake	1105	Rich's Point	172	72	8	87
		Ascot Beach	284	42	23	76

[1] Maximum estimate derived by choosing the higher of the following: the actual number of adults counted at one time, or twice the number of nests

[2] Nests were not actively searched for, but three young grebes were observed with an adult pair, suggesting breeding did occur on the lake.

[3] The majority of these birds were counted at the Moose Lake Provincial Park colony; however 41 of these birds were counted by Canadian Wildlife Service personnel during Franklin's gull nest counts at a separate colony (Beyersbergen and Gingras, *unpublished data*).

4.3 Results from Individual Lakes

4.3.1. Lake Isle

There are two nesting sites (western island and an adjacent eastern island) on Lake Isle that have been used by western grebes since at least 2001. During some years, they use both islands (Hanus et al. 2002a); in 2005 they used only the western island (Berg and Wollis, *unpublished report*), and in 2006 we found 104 western grebe nests on the eastern island but none on the western island. Such behaviour demonstrates an ability to change nesting location between years, and may suggest resilience in the event that one nesting site is compromised. Lake Isle is the only one of the three breeding lakes in the Stony Plain area that has had an overall increase in population since 2001.

On the survey date of 21 July 2006, the majority (88%) of nests were still in good condition (Table 2) and only 4% of nests were still active, confirming that this was the ideal time to do the survey.

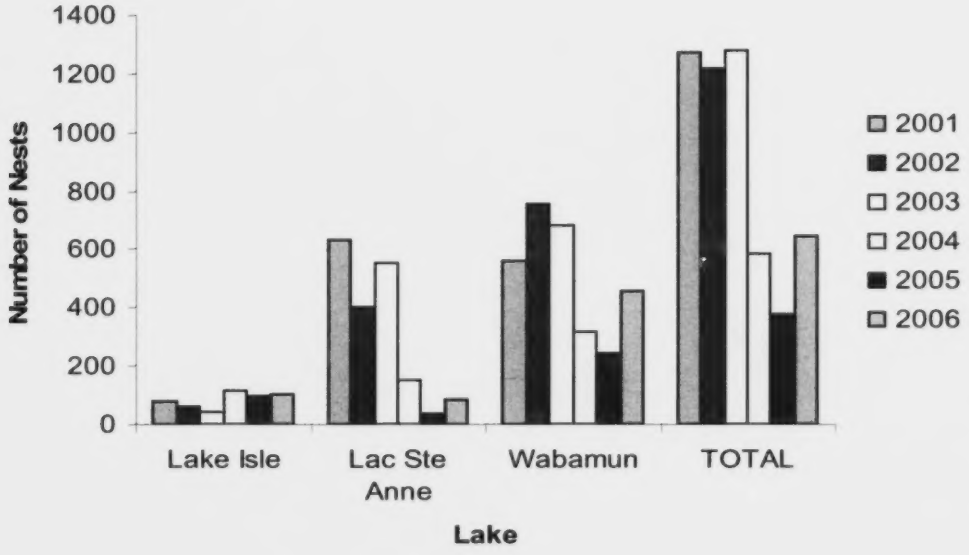

Figure 3: Number of western grebe nests on surveyed lakes in the Stony Plain study area 2001-2006.

4.3.2. Lac Ste. Anne

Meandering shoreline surveys conducted at the narrows (the section that separates the east and west basins of the lake) and along a 2 km stretch of reed bed west of the southern shore colony failed to find any evidence of recolonization of three historical sites (identified in Hanus et al. 2002c). No new colonies were found. The remaining traditional colony site had 88 nests, giving an estimate of 176 adults. A brood count on 24 July 2006 revealed just 81 adults (with 32

young); however, conditions for the survey were poor as a result of high winds and whitecaps on the water.

The currently used colony site on Lac Ste. Anne has been used annually since 2001. The count of 88 nests represents an increase from the 37 nests counted in 2005 (Berg and Wollis 2005, *unpublished report*) (Figure 2). Despite this rebound, there has been an 86% decline in the number of nests on this lake since 2001.

4.3.3. Wabamun Lake

From 2001 to 2005, western grebes at Wabamun Lake nested in one main colony (Rich's Point). The lowest population level (Figure 3) occurred in 2005 with 243 nests (Berg and Wollis 2005, *unpublished report*). Following completion of nesting that year, an oil spill killed a minimum of 333 western grebes, which effectively reduced the total estimated adult population by 69% (G. Berg, pers. comm.; L. Patterson, pers. comm.). In 2006, western grebes returned to nest at Rich's Point. In addition, western grebes established a second colony 2 km west at the Ascot Beach reed bed. Together, these two sites contained 456 nests in 2006. During the brood survey on 10 August 2006, 1105 adults and 123 juveniles were counted. The origin of the birds in the Ascot Beach colony is unknown; perhaps this represents an immigration of new birds and/or a return of individuals that may have nested in the Rich's Point colony in previous years. We have no knowledge as to whether this site had been used in previous years for nesting by western grebes.

4.3.4. Buffalo Lake

Reconnaissance surveys on Buffalo Lake in 2005 confirmed the presence of two western grebe colonies ("western reed colony" and "eastern reed colony") (Berg and Wollis 2005, *unpublished report*). The 2006 field season was the first time nests were counted on Buffalo Lake, and we found 243 and 272 nests in the western and eastern reed colonies, respectively. While 35% of the eastern reed colony nests were already submerged, 89% of the western reed colony nests were in good condition, indicating a later hatch out of nests.

Both colonies are located in secluded bays that do not appear to have much boat traffic. Backshores in both locales are currently undeveloped with the exception of agriculture. Efforts should be made to continue to monitor grebes on Buffalo Lake and take any possible steps to protect the backshores.

4.3.5. Lesser Slave Lake

Records show that Lesser Slave Lake has had as many as three historical colony sites. We failed to find any evidence of breeding at the Auger Bay site; the Giroux site was not investigated but it was suspected there was no nesting there. Nesting was confirmed at the Joussard colony where ground nest surveys on 20 July 2006 revealed a total of 1360 nests, or 2720 adults, 5% of which were still active.

Table 2: Western grebe nest count data on three colonies on Lesser Slave Lake in years in which surveys were conducted.

Colony	1970s	2000	2002	2006
Auger Bay	-	Not active	200	Not active
Giroux	400	Not active	Not active	Not surveyed
Joussard	-	350	1671	1360

4.3.6. Utikuma Lake

Hanneman and Heckbert (2001) cited information from the 1990s stating that there were 206 adults on Utikuma Lake at that time. Their survey in 2000 documented 851 nests in three colonies. However, on 8 June 2006, a complete meandering shoreline survey noted only about 20 adult birds on the water near the location of the old North Island colony, so a detailed nest survey was not done. No other western grebes were seen on the rest of the lake.

No factor has been identified as a cause of the decline in western grebe numbers on this lake. It is unclear whether these birds were killed by some event on their wintering grounds or simply moved to another location to breed. One possible explanation for the disappearance is a massive die-off of fish in the lake. There were a number of fish killed in August 2004 as a result of excessive blue-green algae growth and high temperatures, and evidence of a winter kill was noted the following winter. Poor moisture conditions since 2001 may have further contributed to another winter kill in 2005 (DeRosa 2005, pers. comm.). Overall, water depths at Utikuma Lake remain far below long term averages.

4.3.7. Lac La Biche

An aerial survey of Lac La Biche on 26 June revealed that western grebes were nesting in only one of two previously known colonies. Ground nest surveys on 19 and 20 July 2006 revealed 1 406 western grebe nests, of which 179 (13%) were still active, and another 82% were classified as being in good condition. This is a substantial drop from the count in 2003 of over 4 500 nests (Found and Hubbs 2004). In May and June of 2006 approximately 80 adult western grebes drowned in nets set for whitefish on Lac La Biche (T. Miller, pers. comm.).

4.3.8. Cold Lake

The estimated number of adults breeding on Cold Lake appears to have more than doubled from 2005 to an estimated 1 876 adults. However, some of the nests were suspected as re-nesting attempts, so this may be an overestimate of the true population size. The number of colonies on Cold Lake diminished from two to one between 2005 and 2006.

4.3.9. Other lakes

An additional shoreline survey conducted by powerboat on Lac La Nonne on 7 July 2006 found 10 adults. Poor conditions, with high winds and whitecaps, undoubtedly led to an underestimation. A similar count at Sandy Lake on 10 July 2006 counted 10 adults, including a pair that was carrying three young. At Sandy Lake 21 adult western grebes were counted on the south basin of the lake but no evidence of breeding was apparent. A survey on Thunder Lake on 13 July 2006 revealed just three adults and no evidence of breeding. Table 1 in the Appendix shows the results from all lakes on which western grebes were observed, including some not mentioned above. Berg (pers. comm.) reported seeing about 500 western grebes on Buck Lake in September.

Population trends are not consistent between lakes in northeast Alberta; all show a high level of variability among years. The medium-sized colonies on Angling and Wolf lakes have disappeared, while populations on Hastings and Moose lakes have slightly increased. This further illustrates that western grebes require a network of healthy lakes to sustain regional populations, as water levels and other measures of habitat quality fluctuate between years and between lakes.

4.4 Potential Sources of Error

Some general problems encountered during western grebe surveys likely affected the results of the nest counts. The first problem, which was most apparent in colonies that supported multiple species nesting (such as those at Lac La Biche, Lesser Slave Lake, Lake Isle and Buffalo Lake), was the difficulty in distinguishing whether abandoned nests were those of western grebes, eared grebes or other species, such as black-crowned night heron.

There is also an element of subjectivity inherent in nest identification, causing discrepancies between observers' interpretations, in particular with inexperienced observers, or when different observers were used for different lakes. We hope to minimize this problem in the future with the development of a nest key that includes several photos of nests for each species in a variety of habitats and at various stages of deterioration; this nest key is currently in preparation.

In some cases, eared grebes or Forster's terns nested on abandoned western grebe nest platforms; the potential for under-counting western grebe nests existed if these nests were identified as those of another species during the survey. We recognize that counting nests while western grebes are still incubating would yield more accurate results; however, we have determined the disturbance to the birds would be too great.

An additional problem stemming from the decision to minimize disturbance by counting after the nesting season, is that some structures that resembled abandoned nests may not have once been active. However, if this bias is similar every year, it should not affect the comparison of the colony population size year to year.

Finally, some nests found in very shallow water (<20cm deep) could not sink, thereby artificially inflating the proportion of nests classified as being in good condition, and hence making timing comparisons between lakes difficult. This was particularly prevalent on Lac La Biche, Lake Isle, or other locations where they are built in shallow cattails.

4.5 Threats to Population and Habitat

Western grebes are highly sensitive to disturbance, have very specific habitat requirements, and have declined in numbers in Alberta in recent years. Human threats, either direct or indirect, facing this species are numerous.

Threats to habitat include:

- Loss of emergent vegetation through shoreline development, cattle grazing, and wintertime all-terrain vehicle and snowmobile use;
- Variation in water levels – increased water levels could cause the loss of colonies on shallow reefs, and could impact emergent vegetation making it unsuitable for nesting. Conversely, decreased water levels could expose shallow reefs, effectively reducing the area suitable for nesting. Such a decrease could also deplete fish habitat, thereby negatively affecting the grebes' food source. Drastic fluctuations in water level during nesting could cause nests to be destroyed or left on dry land.

Threats facing populations include:

- Nest abandonment, or nest predation from crows and ring-billed gulls, following human disturbance;
- Widespread damage to nests and loss of eggs following natural storm events;
- Frequent waves from recreational boat traffic;
- Oil or other chemical spills from nearby transportation infrastructure (pipelines, highways, railroads etc.) pipelines or tanker trucks; and
- Drowning in commercial fishing nets.

Undoubtedly all of the above factors have played a role in the decline in nests observed since 2001.

There are two critical points we can draw from these studies in Alberta. First, while large populations of grebes remain, they are concentrated in only a few colonies. Second, the largest few of these colonies are located in the northernmost portion of the species' range, where development near the colony has been minimal. Lack of historical data on lakes where grebes have occurred, or may have occurred and are no longer present, precludes definitive statements about causes of abandonment. However, we recommend steps be taken now to address those factors that can lead to disruption of grebes in colonies or possible colony abandonment.

4.6. Alberta's Western Grebes in a North American Context

Poston et al. (1990) developed a ranking classification for migratory birds inhabiting the Canadian prairie provinces; following this system western grebe colonies with over 500 nests or breeding pairs are considered nationally significant, while colonies with a range of 100 to 500 nests or breeding pairs are considered regionally significant. In 2006, five of the surveyed lakes in Alberta ranked as nationally significant, and three of the surveyed lakes ranked as regionally significant.

The North American Waterfowl Conservation Plan estimated that there are 110 000 breeding adult western grebes in North America. Our estimate of approximately 10 000 breeding adults in Alberta represents a significant proportion of this population. In Canada, western grebes are found only in the four western provinces, primarily on the prairies. Gingras (pers. comm.) reviewed the historical and current status of western grebes in Saskatchewan and Manitoba and determined that there were not enough data to establish a trend. In Saskatchewan, there were seven lakes with recently confirmed populations of western grebes, two of which were of national importance, and three of which were of regional importance. Manitoba does not have a complete recent survey but has at least 4 000 breeding adults in seven nationally important colonies, with nesting confirmed on at least 12 lakes. This situation of only a few lakes supporting large colonies is similar to the Alberta situation, and it is possible that western grebes face similar threats in all three prairie provinces.

5.0 MANAGEMENT IMPLICATIONS AND FUTURE DIRECTION

Alberta supports a significant portion of North America's western grebe population. This species selects large, fish-bearing lakes with suitable emergent vegetation along shorelines. Currently, the most successful western grebe colonies occur in the larger lakes of northern Alberta, specifically Lac la Biche, Cold, and Lesser Slave lakes. In southern, western and central Alberta, most lakes tend to be too shallow to sustain fish populations, lack suitable emergent vegetation, are subject to dramatic water level fluctuation (e.g., lakes used as irrigation reservoirs), or have too much shoreline development and recreational activity to support large grebe colonies.

In Central Alberta, we have seen colonies at Lac Ste. Anne and Wabamun Lake diminished well below numbers found in 2001 and 2002. Of the ten lakes that either currently or recently supported at least 100 breeding adults eight face potential threats. These threats include shoreline development, increased recreational vehicle traffic (powerboats, ATVs, snowmobiles), agricultural development, fish winterkill, fluctuations in water levels, and petroleum spills. These impacts are in addition to those faced by western grebes during the migration and wintering periods, where they are faced with similar threats.

Further, some historic nesting colonies in Alberta are no longer used, and although the reasons for abandonment are unknown, loss and/or degradation of nesting habitat is suspected to be the leading cause The central and northern breeding lakes that support the majority of the provincial

population warrant immediate protection before further anthropogenic disturbance threatens the integrity of this important grebe habitat. While western grebes may exist or even breed on several lakes in small numbers, these very large breeding colonies should be the focus of habitat protection.

Storer and Nuechterlein (1992) noted that colony locations are somewhat traditional but also vary widely with water conditions. Western grebe colonies in Alberta have also demonstrated this pattern through the seven field seasons of this study. We have noted differences at colony sites with respect to water depths, amount of carry over of previous emergent vegetation, density and species composition of emergent vegetation, and proximity of colonies to development. At present we do not fully understand the mechanisms that determine how western grebes select new nesting sites, and whether or not they return to formerly used sites. Future research should be directed toward answering these questions.

Protection for western grebe colonies on lakes with limited recreational development should be completed before conflicts arise with potential development. In situations where western grebe colonies exist on well-developed recreational lakes, public education should continue to focus on local "recreational use" groups, landowners, and land managers at these lakes. Shoreline habitat protection and restoration should also become a priority for this project in the future. Efforts should be made to locate the colony that disappeared from Utikuma Lake. Finally, data should be collected on the number of western grebes lost to commercial fishing nets, and measures should be put in place to ensure such accidental deaths are prevented from occurring again in the future lakes.

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APPENDIX

Table A 1: Survey dates and methods for all grebe surveys conducted in 2005 and 2006

Waterbody	Lake Location (Legal Land Description)	2005		2006	
		Survey Date	Survey Method[4]	Survey Date	Survey Method[1]
Arthur Lake	S22, 23-T55-R5-W5	N/A		July 11	STS
Big Lake	S15, 22-24, 27, 28-T53-R25, 26-W4	June 17	MSBS (Canoe)	July 10	MSBS (Canoe)
Brock Lake	S4, 5, 8, 10-T56-R6-W5	June 29	MSBS (Canoe)	July 11	STS & MSBS (Canoe)
Buffalo Lake	N: S21-T41-R21-W4 S: S6-T40-R21-W4 E: S2-T41-R20-W4 W: S24-T40-R22-W4	N/A		June 22	MSBS (kayak)
				July 17	GNS
Chip Lake	S28, 36-T53-R9,10-W5; S36-T54-R11-W5; S25-T54-R11-W5	N/A		July 12	MSBS (Boat)
Cold Lake	T63–65-R1,2-W4	July 15 July 27	MSBS GNS	July 26	GNS
George Lake	S27, 28, 29, 33, 34-T57-R1-W5	June 27	MSBS (Canoe)	July 5	MSBS (Canoe)
Hastings Lake	T51-R20-W4	July 6	MSBS (Boat)	June 29 & July 13	GNS
Lake Isle	S31, 32-T53-R5-W5; S21-23, 25-28, 35, 36-T53-R6-W5;	June 20	MSBS (Canoe)	June 27	Incidental Observations (Canoe)
	S3-10-T54-R5-W5; S1-T54-R6-W5	July 15	GNS	July 21	GNS
Lac La Biche	N: S4-T69-R15-W5 S: S6-T67-R13-W5	June 7 & 8	MSBS (Canoe)	June 26	Aerial Survey
	E: S7-T67-R12-W5 W: S12-T68-R16-W5	July 25-26	Estimated from boat[5]	July 19	GNS
Lac La Nonne	S7, 18-T57-R2-W5 S13,23,24,26,27,35-T57-R3-W5	N/A		July 7	MSBS (Boat)
Lac Ste. Anne	S15, 16, 20-22, 27-35-T54-R3-W5;	July 22	GNS	June 27	MSBS (Canoe)
	S19, 20, 28-36-T54-R4-W5; S2-10-T55-R3-W5; 1-5, 11,12-T55-R4-W5	July 27	SBS	July 18	GNS
				July 24	SBS
Lesser Slave Lake	N: S33-T75-R7-W5 S: S2-T73-R6-W5	N/A		July 20	GNS

[4] GNS = ground nest surveys; MSBS = meandering shoreline boat survey; SBS = systematic boat survey; STS = shoreline telescope survey; all methods described in Hanus (2002c).

[5] High water levels and poor conditions precluded wading through the colony to count nests

	E: S19,30-T73-R5-W5 W: S33-T74-R14-W5				
Majeau Lake	S4-9,16-18-T57-R3-W5; S1, 12,13-T57-R4-W5	June 28	MSBS (Canoe)	July 4	MSBS (Canoe)
Moose Lake	T60,61–R6,7-W4	June 17 July 17	MSBS (Canoe) GNS	July 25	GNS
Oldman Lake	S21, 28, 32, 33-T56-R4-W5; S5-T57-R4-W5	July 4	STS	July 4	STS
Prefontaine Lake	S32-T55-R6-W5; S5-T56-R6-W5	N/A		July 11	STS
Sandy Lake	T55-R1-W5	N/A		July 10	MSBS (Boat)
Thunder Lake	S24-26, 35, 36-T59-R6-W5; S19, 20, 29, 30-T59-R5-W5	June 21	MSBS (Canoe)	July 13	MSBS (Canoe)
Utikuma Lake	N: S20-T80-R10-W5 S: S26-T78-R10-W5 E: S16-T80-R8-W5 W: S26,35-T79-R11-W5	N/A		June 8	MSBS (Airboat)
Wabamun Lake	S15, 21,22, 27-36-T52-R4-W5; S34-36-T52-R5-W5; S1-9,12-T53-R4-W5; S1-18-T53-R5-W5; S7-T53-R3-W5	July 13	GNS	June 30	MSBS (Boat)
				July 14	GNS (Rich's Point)
				July 27	GNS (Ascot Beach)
				Aug 10	SBS
Wakamao Lake	S33-T59-R24-W4; S4,5,8-T60-R24-W4	July 11	MSBS (Canoe)	June 29	MSBS (Canoe)

Table A 2: Estimated number of adult western grebes on surveyed lakes 2001-2006[1]. Also shown is the average population estimate between 2001 and 2005.

Waterbody	2001	2002	2003	2004	2005	Average[2]	2006
Angling Lake	-	-	60	90	50	-	0
Buffalo Lake[3]	-	-	-	-	-	-	1030
Cold Lake[3]			1982	970	900	-	1876[4]
Hastings Lake[3]			45+	125	8	-	440
Lake Isle[3]	54	124	88	228	192	**137**	208
Lac La Biche (NW shore)[3]	-	-	4582	N/A[5]	1392	-	2812
Lac La Biche (NE Currant Island)	-	-	30[6]	366	400[7]	-	0
Lac La Nonne	-	-	-	-	-	-	10
Lac Ste. Anne[3]	1170	802	1106	308	74	**692**	176
Lesser Slave Lake[3]	-	3742	-	-	-	-	2720
Moose Lake[3]	-	-	39	304	258	-	312
Sandy Lake	-	-	-	-	-	-	21
Thunder Lake	-	-	-	-	-	-	3
Utikuma Lake	-	-	-	-	-	-	20
Wabamun Lake[3]	544	1510	1360	634	486	**906**	1105
Angling Lake	-	-	60	200+	50	-	0
Barbara Lake	-	-	0	0	-	-	0
Brayet Lake	-	-	-	-	-	-	0
Cooking Lake	-	-	-	7	-	-	0
Figure Lake	-	-	0	-	-	-	0
Wolf Lake	-	-	79+	14	0	0	0

[1] Estimated population size derived from actual population counts, or from doubling number of nests counted, whichever value was higher.

[2] Average calculation was based solely on non-zero values, as a zero could indicate no grebes were found, or simply that the survey did not take place that year. Averages were only calculated on lakes with a minimum of four years data between 2001 and 2005

[3] Indicates a breeding lake in 2006.

[4] Cold Lake contained two breeding colonies in 2005 but the smaller, more northerly colony was abandoned in 2006.

[5] Poor weather conditions prevented counting of the larger colony; therefore, this does not represent the entire population

[6] This was in a slightly different location in 2003 than it was in later years.

[7] Nests were not systematically counted, instead they were estimated from the boat.

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